

## **Financial Integration of Stock Markets in the Gulf: A Multivariate Cointegration Analysis**

**Aqil Mohd. Hadi Hassan**

*Department of Economics, College of Business and Economics  
P.O. Box 17555 United Arab Emirates University AL Ain  
United Arab Emirates  
aqilh@uaeu.ac.ae*

### **ABSTRACT**

This paper uses multivariate cointegration techniques developed by Johansen (1988, 1991, 1992b) and Johansen and Juselius (1990) to test for the existence of long-term relationships between share prices in the gulf region. Using a vector-error-correction model the paper also investigates the short-term dynamics of prices by testing for the existence and direction of intertemporal Granger-causality. The analysis of weekly price indices in Kuwait, Bahrain, and Oman stock markets shows that: (i) share prices are cointegrated with one cointegrating vector and two common stochastic trends driving the series, which indicates the existence of a stable, long-term equilibrium relationship between them; (ii) prices in Kuwait and Bahrain are adjusting to the long-term equilibrium state whereas prices in Oman are exogenous; and (iii) prices are not affected by short-term changes but are moving along the trend values of each other. Therefore, information on the price levels is helpful for predicting their changes.

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*Keywords: Gulf Cooperation Council; Share prices; Cointegration; Causality; Prediction.*

## I. INTRODUCTION

Stock markets in the Gulf Cooperation Council<sup>1</sup> (GCC, thereafter) countries have changed drastically over the last five years; privatization programs and new issues of shares have come to surface. The development in computer-based trading and the inter-listing of shares on their stock markets is the concern of authorities in these countries. In the past few years there was cooperation between stock markets in the region. This cooperation has come in the form of cross listing. In March 1995, the Bahrain stock market established full linkage with Omani stock market. This gave opportunity for investors in both countries to deal in 110 listed shares. Bahrain Stock market is also considering listing other GCC companies. Kuwait stock market is not linked to any of the stock markets in the region but it has allowed GCC nationals to own shares of the Kuwaiti companies listed on the exchange, with a restriction that they cannot hold more than 49% of the total shares outstanding of banks and insurance companies.

Empirical evidence by Swanson (1987) suggests that world stock markets are becoming more integrated. This might be true for stock markets in developed countries as in United States, Japan, United Kingdom and other European countries, but to what extent this might be the case for stock markets in developing nations, especially in the gulf states where share dealings is a new phenomena. Hence, the purpose of this paper is to test the efficient market theory<sup>2</sup>, i.e., to investigate empirically the existence of long-term relationships between share prices in the GCC stock markets. For this we use recent multivariate cointegration techniques developed by Johansen (1988, 1991, 1992b) and Johansen and Juselius (1990). In addition, short-term relationships are investigated using the Granger-causality test. As Granger (1986, 1988) points out, if two variables are cointegrated then granger-causality must exist in at least one direction.

It has been well established in the literature that international stock markets are becoming more integrated, and equity prices on these markets are exhibiting long-run relationships. This is due to the increasing liberalization and globalization of capital markets. Numerous numbers of studies has tested the relationships among international stock markets, however, most of these studies focused on highly developed stock markets in USA, London, Japan, Germany, Australia, Singapore and Hong Kong. For example, Chou et al (1984) base their work on weekly data of the stock market indices of the United States, the United Kingdom, Japan, France, Germany and Canada. Moreover, Kwan et al (1995), base their study on the monthly data drawn from nine major stock market indices of Australia, Hong Kong, Japan, Singapore, South Korea, Taiwan, the United Kingdom, Germany and the United States. This study departs from previous studies by focusing on newly developed stock markets. It looks at three Arabian Gulf stock markets, namely Kuwait, Bahrain and Oman. Since these countries are members of the GCC, their stock markets may exhibit some kind of relationship. As one of GCC's main objectives is to work towards economic integration of its states and to form a single market. They have opened their economies to each other and allowed ownership of assets in any member country to all nationals of the GCC countries. They also agreed to coordinate in their economic policies to achieve economic integration.

The paper is organized as follows. Section II gives a brief description of the stock markets in the GCC countries. Section III describes the data and the econometric methodologies used in testing the relationship between the markets. Section IV discusses the main empirical results and the conclusion is presented in section V.

## II. GCC STOCK MARKETS: AN OVERVIEW

During the 1980's and 1990's financial services developed an increasingly important role in the GCC countries. This has come as a result of these countries being engaged in commercial oil production, which accumulated large amount of oil income. This development gave an impetus to the development of financial institutions in these countries. Cooperative efforts have so far been made to develop interaction and integration between their respective economies, but coordination efforts ought to be further strengthened by developing the local capital markets and encouraging the inter-listing of domestic companies.

Most GCC countries have similar financial systems, which mainly consist of the central bank, commercial banks, insurance companies, stock broking firms, stock exchanges, etc. However, Kuwait, Bahrain and Oman are the only countries in the region with formal stock markets. Plans for organized stock markets in other GCC countries have been in the making for several years. But due to the lack of general public awareness and sophistication with regard to stock issuance and trading and the small potential markets resulted in little interest in developing formal markets. Also, most of the GCC stock markets are relatively small and virtually closed to foreign investors, leading to block of foreign portfolio investment inflows. However, this is rapidly changing. For example, in recent years resident expatriates are allowed to invest in funds especially founded to deal in domestic stock markets.

The six GCC countries are characterized by being capital surplus open economies, in the sense that there are no exchange and capital flow restrictions, which are helpful to capital markets development. Their currencies are stable to each other as most of them are pegged to the US dollar with the exception of Kuwaiti Dinar, which is determined on the basis of a weighted basket of currencies of Kuwait's major trading partners with the US dollar having the greatest weight.

The stock markets of the GCC countries are still small; by 1996 the number of listed companies reached 292 with total market capitalization equivalent to US \$66.7 billion and annual turnover of US \$9.3 billion<sup>3</sup>. By year 2000 total market capitalization for the six stock markets in the GCC countries amounted to around US \$145. Bahrain's stock market, which was opened in 1989, is considered to be the most advanced in the region. Forty one companies are listed on the exchange, with total capitalization of US \$6.6 billion in 2000. The Bahrain Stock Market is open partially to foreign investors, as their holdings cannot exceed 1% of the shares of any given company.

Kuwait stock market is the oldest in the region; officially it was opened in 1977. The number of companies listed on the exchange decreased from 54 before the Iraqi invasion to 48 at the end of 1994 then increased to 86 by the end of 2000, with total

market capitalization of US \$19.8 billion. Despite its small size, the Kuwaiti stock exchange is one of the most dynamic in the world; turnover sometimes exceeds that of the London stock exchange.

Oman's stock market was established in May 1989. By the end of 2000, the number of listed companies was 131 with total capitalization estimated at about US \$3.5 billion. The market performed well in 1996, with a rise of 26% in the market index. Foreign investors can invest in the Omani stock market through mutual fund with a maximum holding of 49% of this mutual fund. To boost its stock market, Omani government initiated a large-scale program of privatization; by 1994 US \$250 million was raised (Eissa, 1997).

Qatar has approved plans to set up an official stock exchange. The obstacle in this country is that there are not many companies and ownership of shares usually is in the hands of government or few individuals. There are only around 20 banks and companies trading in the market with very low turnover.

Saudi Arabia has the largest stock market in the region in terms of capitalization, which was US \$39 billion at the end of 1996 and has increased to US \$73 billion in 2000, with 75 companies listed on the exchange. Only nationals can acquire and trade in shares. Recently, other GCC nationals were allowed to trade and own Saudi shares but up to 25% of the capital. All trading in the Saudi shares are done through banks, which act as brokers as required by the monetary authority. In 1990, a computerized screening system was developed to facilitate the trading under the scrutiny of the central bank, Saudi Arabian Monetary Agency (SAMA).

The United Arab Emirates (UAE) has established its official stock market in 1999. There are only around 20 active shares listed in the market, although there are more than 80 companies eligible to be listed. The market capitalization stood at around US \$29 billion in 2000. The volume of trade and turnover are very low in the UAE market and this is due to the fact that the government owns a large percentage of shares in the companies (sometime reaches up to 80%) and also due to restriction of dealings to nationals.

### III. DATA AND ECONOMETRIC METODOLOGY

The Arab Monetary Fund, department of capital markets, has provided the data used in the study. The department has built a database for 9 stock markets in the Arab region. Our choice of the data was limited to GCC countries; this left us with four countries with official stock markets, namely, Kuwait, Oman, Bahrain and Saudi Arabia in the data base. Unfortunately, we had to choose only three of the four countries, Kuwait (K), Oman (O) and Bahrain (B), because they had full weekly share price indices ranging from October 1994 to August 2001.

Our study of testing whether there is a long-run statistical relationship among Gulf stock markets depends on the methods of Johansen's cointegration analysis. The idea for the analysis is that if two series each follow upward trend, then, in general, they will diverge in the long run. The exception to this is when there is functional relationship between the variables such that the residual from this relationship is

stationary. In this case, the variables are said to be cointegrated. Our approach will comprise of two parts: (1) testing for a unit root in each share price indices, and (2) testing for the number of cointegrating vectors in the systems of share prices, provided the null hypothesis of a unit root for every stock market price index is not rejected.

The test used to investigate the existence of unit roots in the level variables as well as in their first differences are the augmented Dickey-Fuller (ADF) test [Dickey and Fuller, (1979, 1981)] and Phillips and Perron (P-P) test [Phillips and Perron (1988)]. These tests are based on the following two regressions:

$$\Delta x_{it} = \mu + \alpha x_{it-1} + \sum_{j=1}^m b_j \Delta x_{it-j} + \varepsilon_{it} \quad (1)$$

and the second unit root test which allows for the existence of a deterministic trend

$$\Delta x_{it} = \mu + \beta T + \alpha x_{it-1} + \sum_{j=1}^m b_j \Delta x_{it-j} + \varepsilon_{it} \quad (2)$$

where  $x_t$  is the share price series,  $\varepsilon_t$  is the residual term and  $T$  is a time trend. The null hypothesis is that the variable under consideration has a unit root. In each case the lag-length is chosen by minimizing the final prediction error (FPE). We also tested for the tenth order serial correlation in the residuals of each regression using the Ljung-Box Q statistics.

The next stage in the analysis is to test for the presence of cointegration in the three-variable vector of share price indices. We employ the approach of Johansen (1988) and Johansen and Juselius (1990). Their approach is to consider the vector autoregressive (VAR) model of the form

$$X_t = \mu + \Phi_1 X_{t-1} + \Phi_2 X_{t-2} + \dots + \Phi_k X_{t-k} + \eta_t, \quad t=1,2,\dots,T. \quad (3)$$

where  $X_t$  is a 3 x 1 vector containing logarithm of share price indices of Bahrain (B), Kuwait (K), and Oman (O). Suppose that all share price series are  $I(0)$  after applying the differencing filter once. If we exploit the idea that there may exist co-movements of these variables and possibilities that they will trend together towards a long-run equilibrium state, then by the Granger representation theorem, we may posit the following testing relationships that represent a vector error-correction (VEC) model

$$\Delta X_t = \mu + \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \dots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \eta_t, \quad t=1,\dots,T \quad (4)$$

where  $\Delta X_t$  is the vector of first differences of the variables, the  $\Gamma$ 's are estimable parameters,  $\Delta$  is a difference operator,  $\eta_t$  is a vector of impulses which represent the unanticipated movements in  $X_t$ , with  $\eta_t \sim \text{iid}(0, \Sigma)$  and  $\Pi$  is the long-run parameter matrix. With  $r$  cointegrating vectors ( $1 \leq r \leq 3$ ),  $\Pi$  has rank  $r$  and can be decomposed as  $\Pi = \alpha\beta'$ , with  $\alpha$  and  $\beta$  both 3 x  $r$  matrices.  $\beta$ 's are the parameters in the cointegrating relationships and  $\alpha$  are the adjustment coefficients which measure the strength of the cointegrating vectors in the VEC model. Attention focuses on the long-run parameter matrix  $\Pi$ . The Johansen (1988, 1991) approach estimates the long-run or cointegrating

relationships between the non-stationary variables using a maximum likelihood procedure which tests for the cointegrating rank  $r$  and estimates the parameters  $\beta$  of these cointegrating relationships. As proved in Johansen (1991, 1992b), the intercept terms in the VEC model should be associated with the existence of a deterministic linear time trend in the data. If, however, the data do not contain a time trend, the VEC model should include a restricted intercept term associated to the cointegrating vectors.

The VEC model describes how the system is adjusting in each time period towards its long-run equilibrium state. Since the variables are supposed to be cointegrated then, in the short-term, deviations from this long-run equilibrium will feed back on the changes in the dependent variables in order to force their movements towards the long-run equilibrium state. Hence the cointegrating vectors from which the error-correction terms are derived are each indicating an independent direction where a stable, meaningful long-run equilibrium state exists. The coefficients of the error-correction terms, however, represent the proportion by which the long-run disequilibrium in the dependent variables is corrected in each short-term period.

The cointegration methodology pioneered by Granger (1986), Hendry (1986) and Engle and Granger (1987) opened a new channel towards testing for Granger-causality.<sup>4</sup> As Granger (1986, 1988) pointed out, if two variables are cointegrated then Granger-causality must exist in at least one direction. This result is a consequence of the relationships described by the error-correction model. Since the variables may share common stochastic trends, then the dependent variables in the VECM must be Granger-caused by lagged values of the error-correction terms which themselves are functions of the lagged values of the level variables. Hence, the temporal Granger-causality between the variables can be investigated by applying a joint F-test or Wald  $\chi^2$  test to the coefficients of each explanatory variable in the VECM. Therefore we consider that a variable Granger-causes the other if it helps predict its future values.

#### IV. EMPIRICAL RESULTS

Unit root tests are presented in Table 1. The second and the third columns of the table report tests of stationarity about a non-zero constant. As shown in the first half of the table, the null hypothesis that the level variables contain unit roots cannot be rejected by both tests. We then test for stationarity around a deterministic linear time trend. The results of these tests are reported in the last two columns of table 1. Again the null hypothesis that each of the time series has a unit root cannot be rejected. The bottom half of table 1 reports results of testing for unit roots after differencing the data once, that is, the return on holding shares. Both tests reject the null hypothesis. Since the data appear to be stationary in first differences, no further tests are performed.

The results of table 1 are consistent with the null hypothesis that the level variables are each integrated of order one. We now proceed to the second phase of the test, the possibility that there are long-term equilibrium relationships among stock markets in the Gulf using cointegration test on the set of all three stock market indices.

**Table 1**  
Test results for unit roots

Variable	Stationarity Around a Non-Zero Mean		Stationarity Around a Linear Trend	
	ADF	P-P	ADF	P-P
$B_t$	-1.113	-1.497	-0.897	-1.451
$K_t$	-1.266	-1.524	-1.314	-1.577
$O_t$	-1.017	-0.773	-1.236	-1.030
$\Delta B_t$	-10.751	-34.723		
$\Delta K_t$	-8.329	-23.110		
$\Delta O_t$	-7.382	-19.881		
5% critical values	-2.868	-2.868	-3.422	-3.422

**Table 2**  
Testing the rank of  $\Pi$

Trace				$\lambda_{\max}$				
H0	H1	Stat.	90%	H0	H1	Stat.	90%	$\lambda$
$r = 0$	$r \geq 1$	32.86	31.88	$r = 0$	$r = 1$	17.50	14.09	0.0399
$r \leq 1$	$r \geq 2$	15.36	17.79	$r \leq 1$	$r = 2$	9.51	10.29	0.0219
$r \leq 2$	$r \geq 3$	5.85	7.50	$r \leq 2$	$r = 3$	5.85	7.50	0.0135

Before applying the Johansen procedure to estimate  $\alpha$  and  $\beta$ , it is necessary to determine the lag length,  $k$ , of the VAR, equation (1), which should be high enough to ensure that the errors are approximately white noise, but small enough to allow estimation. For this we used the Akaike's Final Prediction Error (FPE) and selected  $K=6$ .

The results of testing for the number of cointegrating vectors are reported in table 2, which presents both the maximum eigenvalue ( $\lambda_{\max}$ ) and the trace statistics, the 10 percent critical values as well as the corresponding  $\lambda$  values. This test is performed using a restricted formulation of the VAR model that assumes absence of a deterministic time trend in the data. From Table 2 we can see that both tests yield the same result that suggests the existence of one cointegrating vector and, hence, there are two common stochastic trends driving the series. Since the results above assume absence of a linear time trend in the data, we now test the cointegration rank and the existence of a time component jointly using the Johansen (1992b) trace test. The procedure of this test is as follows: Let  $M_{i,j}$  denote the combination of rank and deterministic component where  $i$  is the rank ( $i = 1, \dots, 3$ ) and  $j$  is the model,  $j = 0$  is the model with no time trend in the data and  $j = 1$  is the model with a time trend in the data. We start from the most restricted model  $M_{0,0}$  and compare the trace test statistic to the

corresponding critical value. If the model is rejected we keep the rank assumption and change the model of the deterministic trend to the next one. So we continue to model  $M_{0,1}$ . If this model is also rejected we change the rank to  $i = 1$  and go through the same procedure for  $j = 0$  and  $j = 1$ . We keep changing  $i$  and  $j$  until the first time the joint hypothesis is accepted.

The results of this test are reported in Table 3 where we can see that model  $M_{1,0}$  is the one consistent with the data. Thus, we conclude that the rank is equal to one and that the data do not contain a deterministic linear time trend. Therefore, we use a restricted intercept in the VAR and one cointegrating vector.

**Table 3**  
Joint determination of the rank and the deterministic component

Specification	Trace	90%	Decision
$M_{0,0}$	32.86	31.88	Reject
$M_{0,1}$	32.47	26.70	Reject
$M_{1,0}$	15.37	17.79	Accept

**Table 4**  
 $\alpha$  and  $\beta$  vectors

Variable	$\beta'$	$\alpha$
$B_t$	1	-0.007 (2.882)
$K_t$	-1.729 (3.093)	0.007 (-2.872)
$O_t$	-0.722 (0.731)	-0.001 (-0.255)
Constant	184.79	

Note: T-ratios are in parentheses.

The estimates of  $\beta$  and  $\alpha$  from model  $M_{1,0}$  are presented in Table 4. From the  $\alpha$  vector one quickly notices that the coefficients on the cointegrating vector in the  $\Delta O$  equation is small and insignificant. Moreover, testing for exogeneity of the variables, we fail to reject the hypothesis for Oman with likelihood ratio of 0.03 compared to  $\chi^2(5) = 3.84$ . The test is rejected for both of Bahrain and Kuwait with likelihood ratio tests of 5.04 and 5.08 respectively.

The results of cointegration suggest that Kuwait and Bahrain have a meaningful, stable long-term relationship. In this section we test whether variables are related in the short-run. For this we test for the existence of Granger-causality. Table 5 presents the results of testing for Granger-causality between changes in the variables based on the

exogeneity of Oman. The flow of causality in this table is going from the variables in the first column to the variables in the first row.

**Table 5**  
Test results for Granger-causality

Variable	$\Delta B_t$	$\Delta K_t$	$\Delta O_t$
$\Delta B_t$	-	1.138	0.755
$\Delta K_t$	0.434	-	1.063
$\Delta O_t$	0.452	5.534*	-

\* Significant at the 5% critical value.

The results of Table 5 indicate that, in the short-term, the variables do not Granger-cause each other at any level of significance, except for the case of Oman, which causes Kuwait. Hence there is no significant short-term relationship between the variables. Given the result that Kuwait and Bahrain are cointegrated and are adjusting to the long-term equilibrium state, we can conclude that their short-term changes are affected only by their trend values. Hence they are adjusting only to their long-run equilibrium relationship. Therefore prediction of price changes in one market based on information from the other is made possible through the long-term relationship between the levels of the variables.

## V. CONCLUSIONS AND POLICY IMPLICATIONS

This paper investigated the intertemporal interactions among share prices in three Gulf Cooperation (GCC) countries' stock markets, namely in Kuwait, Bahrain and Oman. Using a vector-error-correction (VEC) approach and the Johansen technique of multivariate cointegration, we estimated the long-term relationship among share prices drawn from stock markets in these countries. We also tested for the existence of short-term relationships using the concept of causality.

Using weekly data the analysis shows that share prices in Kuwait and Bahrain are cointegrated with one cointegrating vector, which means the existence of a stable, meaningful long-term relationship between share prices in these two countries. However, share prices in Oman are found to be exogenous in the system. In the short-term, share prices are not adjusting to changes in each other, but moving along the trend values. Hence prediction of future movements in share prices can only use information on price levels and the long-run relationship.

Policy implications of our analysis indicate that investors in the Gulf region can have potential benefits from investing in other stock markets. The study shows that investors in Kuwait can benefit, at least in the long run, from information available in Bahrain Stock Market and vice versa. Hence these markets achieve a greater efficiency by removing restrictions on the ownership at least for the GCC nationals, and this, in turn, will provide a greater opportunity for investors to diversify their portfolios.

Moreover, more liberalization is needed for the GCC countries to reach their objectives of a single market. If the GCC countries would like to move towards a single market economy and establish a single stock market in the region, then they should put more emphasis on the liberalization of their domestic stock markets and coordinate their economic and financial policies toward financial integration within the GCC countries. The base for a single market exists in these countries, as all these countries have similar political, social, economical environments. For example, no restrictions on fund transfers, their currencies are pegged to the US dollar, and therefore no currency risk will be faced by national and international investors.

GCC states must also look into the possibility of liberalization of their stock markets to foreign investors. As international liberalization is eminent, stock markets around the world are becoming more open to foreign investors. The GCC countries, therefore, must coordinate their economic and financial policies toward integrating their markets with other markets outside the GCC, especially the Middle East. Only two of the six GCC countries have fully opened their markets to foreign investor, Bahrain and Oman, Kuwait is partially open, while Saudi Arabia is closed to foreign investors, they can only deal through mutual funds designed especially for foreigners. The United Arab Emirates allows only foreigners to deal in only one single company, with a maximum ownership of 20%. Qatar allows foreigners to deal in two companies. Opening GCCs' economies can increase the ability of domestic companies to compete in international markets, which may decrease the dependency of these economies on oil and oil products, which, in turn, minimizes the impact of oil shocks. Oil revenue has always been a driven force to the activities of stock markets in the GCC countries. A high correlation exists between share prices and oil prices, and it seems that this will continue in the near future, as most of these economies are oil dependent, and are heavily investing in petrochemical industries.

As a matter of fact, the GCC economies have reached a point where there is a need to review most of economic policies towards foreign investors in order to minimize the impact of oil shocks and also to face the requirement of WTO when it is effected.

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#### **NOTES**

1. The Gulf Cooperation Council (GCC) was established in 1981 and it includes six countries, namely, Saudi Arabia, Kuwait, Oman, United Arab Emirates, Qatar and Bahrain.

2. Efficient market theory in the weak-form assumes that the only information of interest is past share prices. See Fama (1965,1970) for a review of the efficient market theory.
3. For an overview of stock markets in the Arab world see AMF (1997,2001) and Azzam (1995).
4. Causality is a subject of great controversy among economists. See Zellner (1988) for a detailed discussion of this issue. Interested readers could also refer to a supplementary issue of the *Journal of Econometrics*, September-October 1988, which includes studies discussing the subject. This paper uses the concept of causality in the probabilistic sense rather than in the deterministic sense. Moreover, causality defined here is in the Granger temporal, rather than the structural sense.

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